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Matsushita et al.

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(54) **HYDRAULIC BRAKE CONTROL APPARATUS**

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B60T 7/10	(2006.01)
B60T 11/16	(2006.01)
B60T 11/18	(2006.01)

(52) **U.S. Cl.**

CPC ***B60T 7/102*** (2013.01); ***B60T 11/165*** (2013.01); ***B60T 11/18*** (2013.01)

(58) **Field of Classification Search**

CPC B60T 7/08; B60T 7/102; B60T 11/165; B60T 11/18; B62K 23/02; B62K 23/06; B62L 3/00; B62L 3/02; B62L 3/023

USPC 188/344, 24.11, 24.15, 24.22; 74/502.2

See application file for complete search history.

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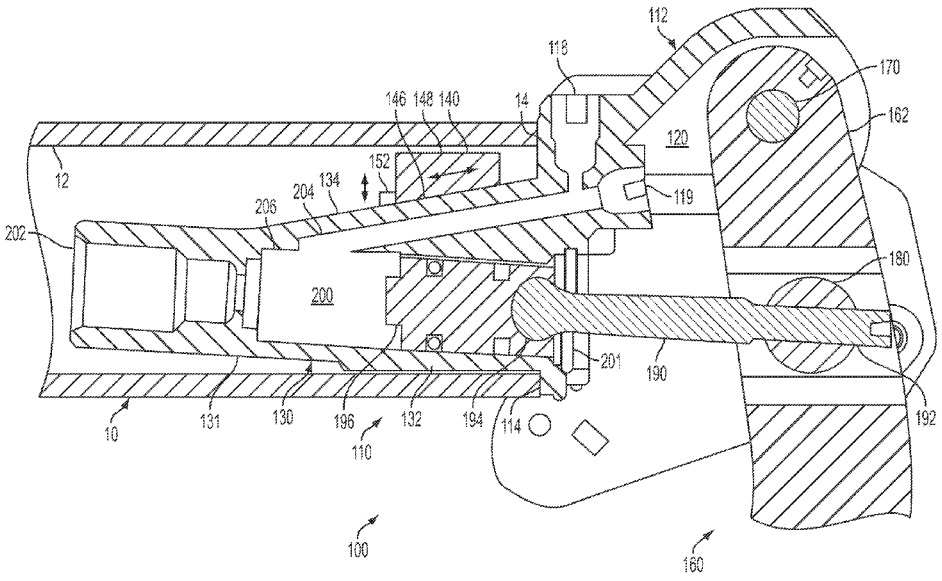
(57) **ABSTRACT**

A hydraulic brake control apparatus including a body portion, a hydraulic brake control mechanism, and a lever portion. The body portion has a first section configured to fit within an interior of a bar opening and a second section configured to be mounted outside of the interior of the bar opening. The hydraulic brake control mechanism includes a hydraulic brake pressure cylinder having a piston chamber therein, where at least a portion of the hydraulic brake control mechanism is housed within the first section of the body portion. The lever portion connected to the body portion and configured to actuate the hydraulic brake control mechanism. The body portion includes a port fluidly connected to the piston chamber by a conduit. The port is provided on the second section in order to allow bleeding of air from within the piston chamber when the body portion is mounted to the bar opening.

12 Claims, 5 Drawing Sheets



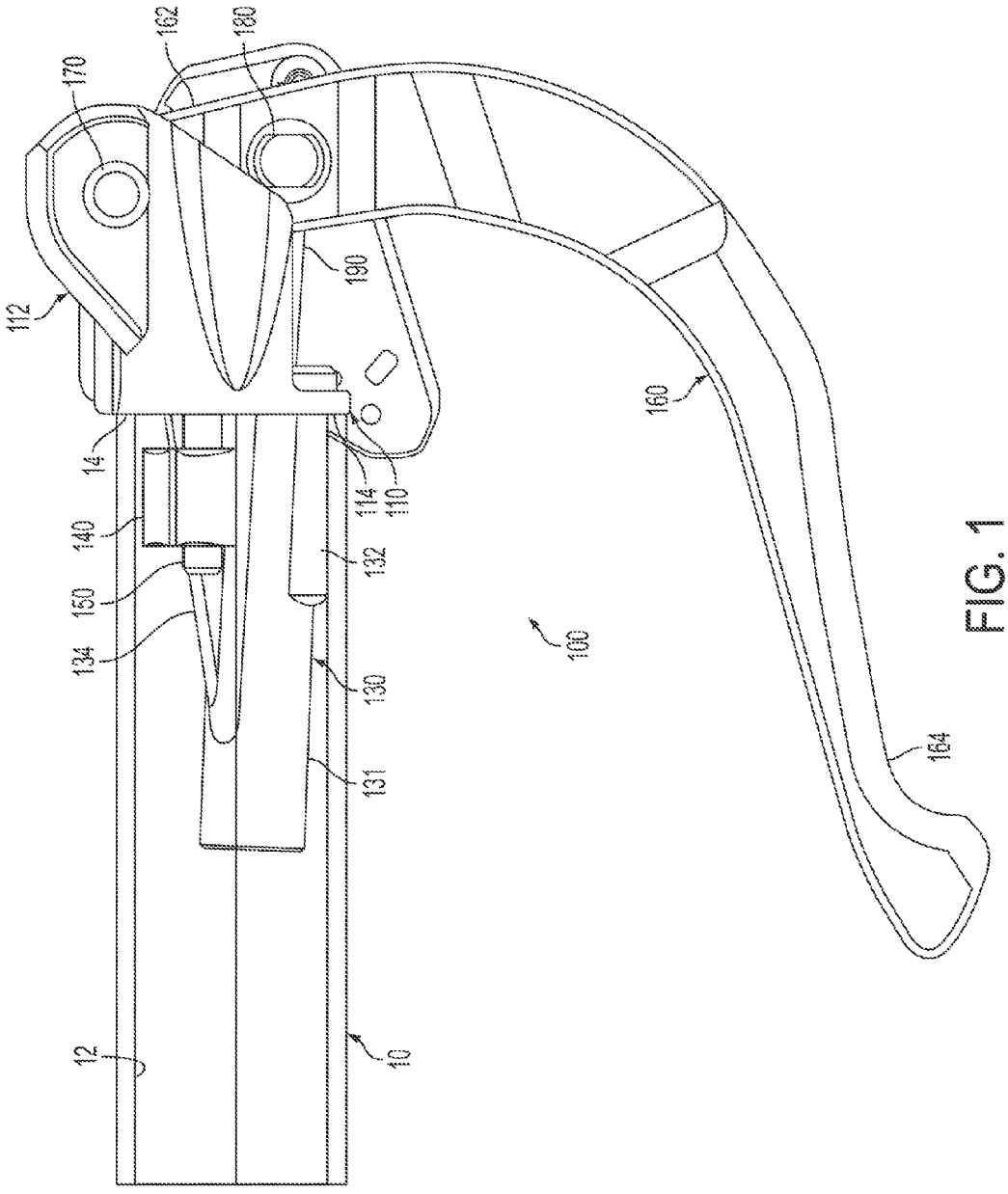

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FIG. 1

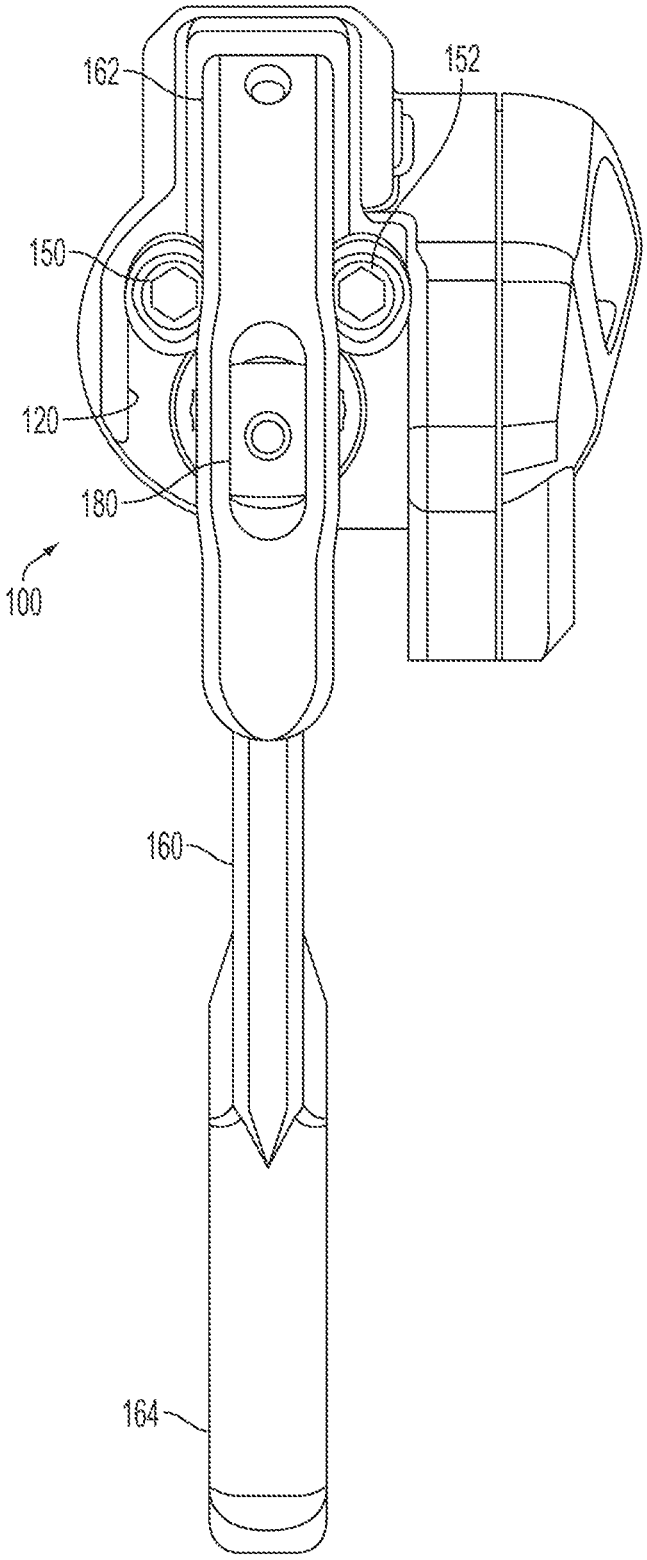

FIG. 2

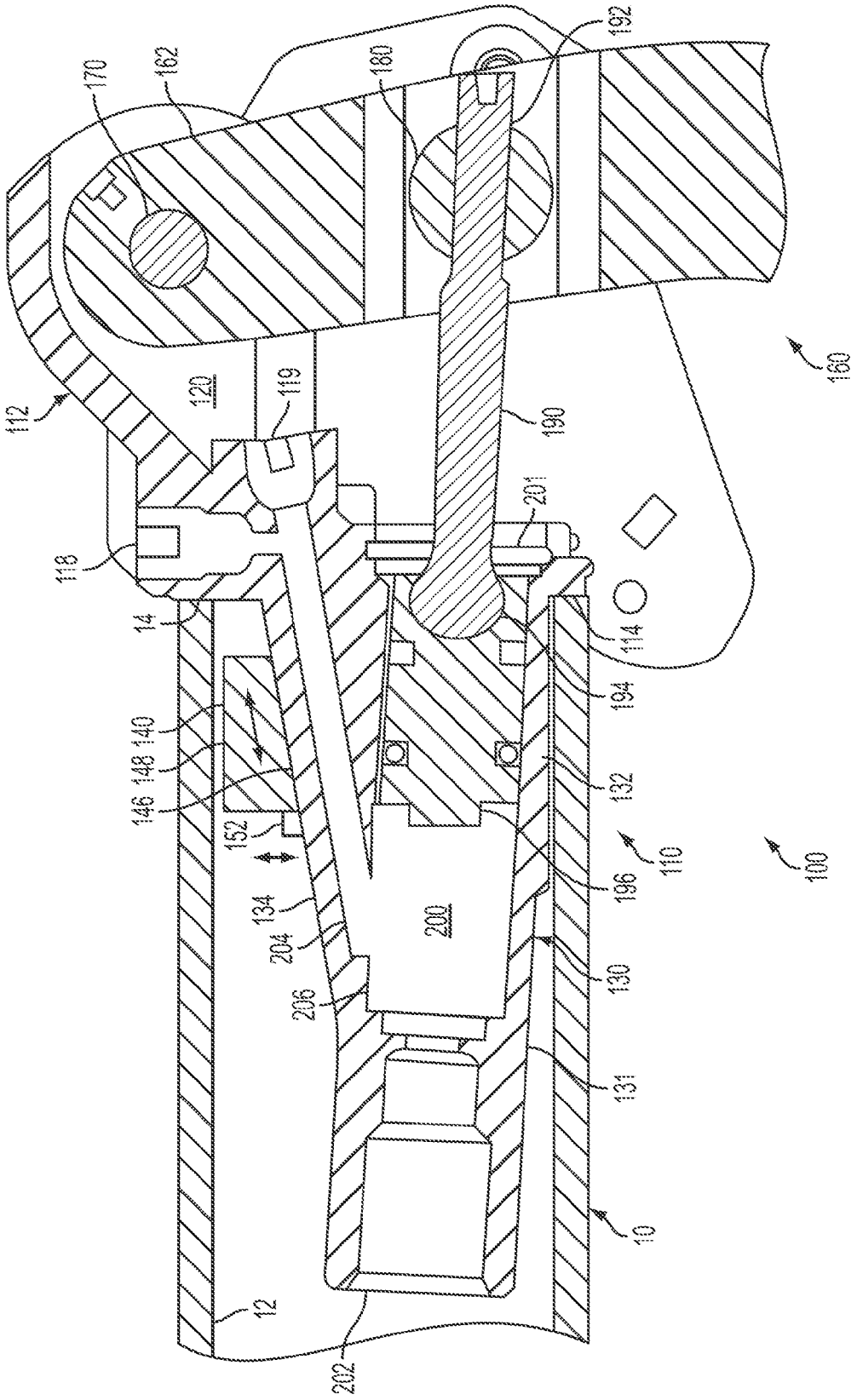
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FIG. 3

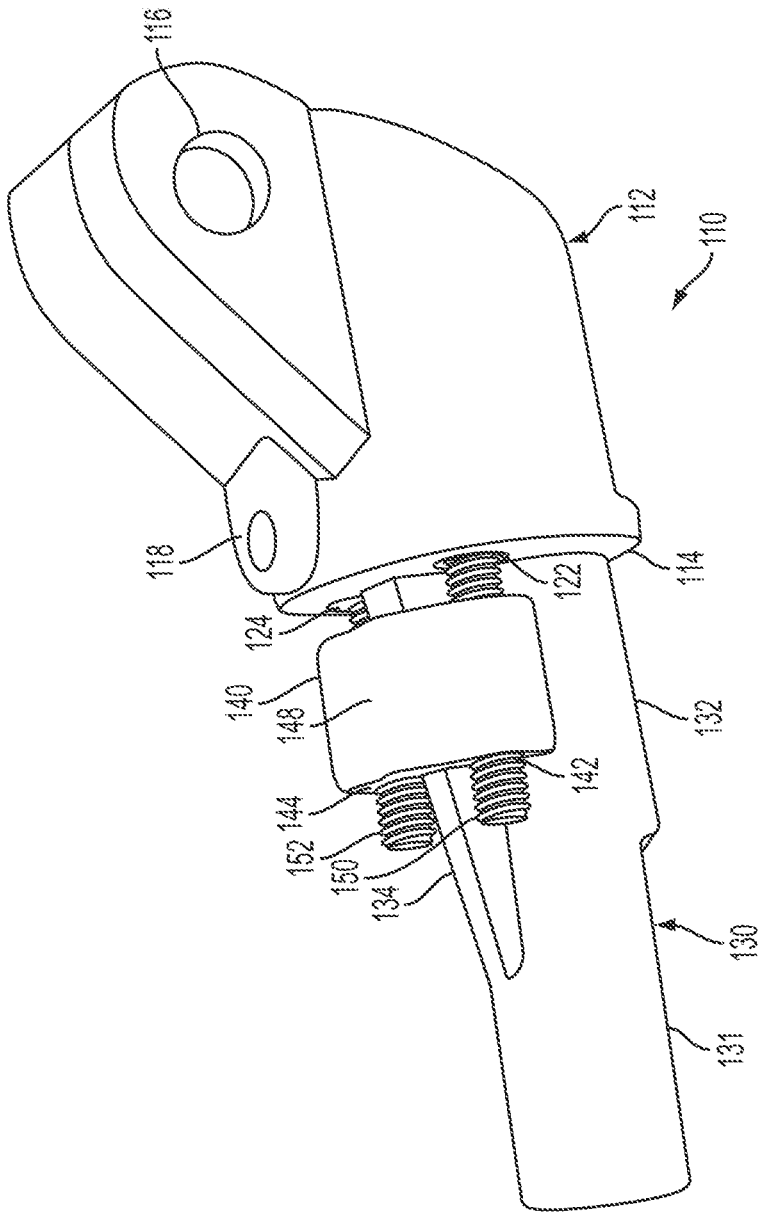
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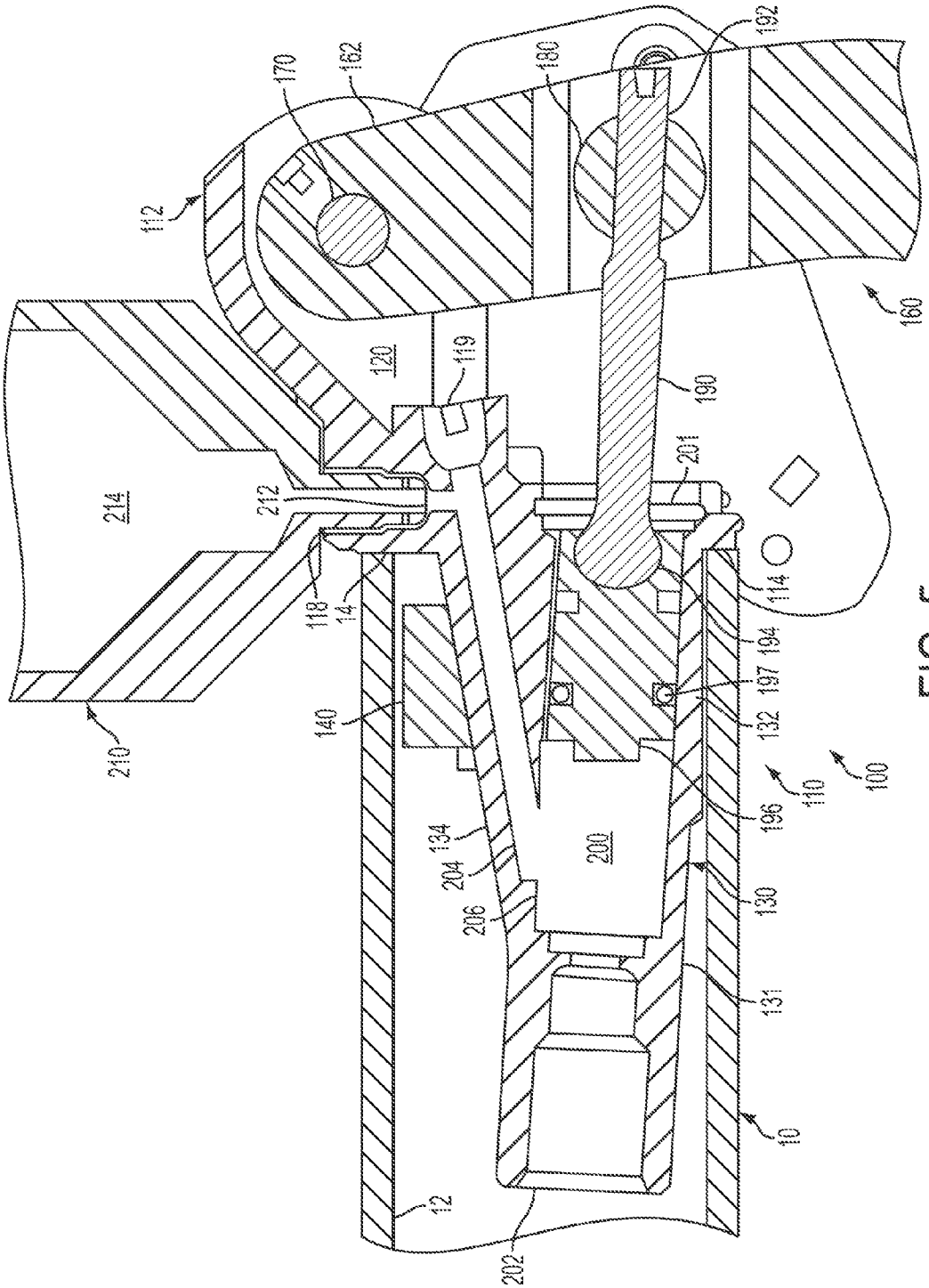
FIG. 4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202

FIG. 5

HYDRAULIC BRAKE CONTROL APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a hydraulic brake control apparatus, and more particularly to a hydraulic brake control apparatus with a portion embedded in a bar opening of a bicycle handlebar.

2. Discussion of the Background

Hydraulic brake systems have been utilized on bicycles to provide powerful, safe, and stable braking effects. Such hydraulic brake systems can include a brake lever mounted on a handlebar of a bicycle, a disc brake mounted beside a wheel of the bicycle, and a hydraulic tube interconnecting the brake lever and the disc brake. Due to the size and shape of the components of conventional hydraulic brake levers, such brake levers are typically mounted on the handlebar using a bracket affixed to an outer circumference of the handlebar. However, such a mounting configuration may not be ideal, since many of the components of the hydraulic brake lever may be exposed and therefore susceptible to damage or environmental factors.

Accordingly, an improved hydraulic brake lever is desired.

SUMMARY OF THE INVENTION

An embodiment of the present invention advantageously provides a hydraulic brake control apparatus comprising a body portion, a hydraulic brake control mechanism, and a lever portion. The body portion has a first section configured to fit within an interior of a bar opening and a second section configured to be mounted outside of the interior of the bar opening. The hydraulic brake control mechanism includes a hydraulic brake pressure cylinder having a piston chamber therein, where at least a portion of the hydraulic brake control mechanism is housed within the first section of the body portion. The lever portion connected to the body portion and configured to actuate the hydraulic brake control mechanism.

A further embodiment of the present invention further advantageously provides that the body portion includes a port fluidly connected to the piston chamber by a conduit. The port is provided on the second section in order to allow bleeding of air from within the piston chamber when the body portion is mounted to the bar opening.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will become readily apparent with reference to the following detailed description, particularly when considered in conjunction with the accompanying drawings, in which:

FIG. **1** is a front, elevational view of a hydraulic brake control apparatus including a control lever, which is mounted to a handlebar, according to an embodiment of the present invention;

FIG. **2** is a right side elevational view of the hydraulic brake control apparatus including the control lever of FIG. **1**;

FIG. **3** is a front, partial, cross-sectional view of a hydraulic brake control apparatus including a control lever, which is mounted to a handlebar, according to an embodiment of the present invention;

FIG. **4** is a front, top, left perspective view of a body portion of the control lever including a mounting portion and mounting screws, according to an embodiment of the present invention; and

FIG. **5** is a front, partial, cross-sectional view of a hydraulic brake control apparatus including a control lever, which is mounted to a handlebar, where a funnel is used to bleed air from a hydraulic brake pressure cylinder, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS OF THE INVENTION

Embodiments of the present invention will be described hereinafter with reference to the accompanying drawings. In the following description, the constituent elements having substantially the same function and arrangement are denoted by the same reference numerals, and repetitive descriptions will be made only when necessary.

FIG. **1** is a front, elevational view of a hydraulic brake control apparatus including a control lever **100**, which is mounted to a handlebar **10**, according to an embodiment of the present invention. In FIG. **1**, for the sake of simplicity and ease of depiction, the handlebar **10** is shown as being transparent so that components of the hydraulic brake control apparatus that are received within the handlebar **10** can be seen therethrough.

FIGS. **1-3** depict a handlebar **10** that is a tubular member having a hollow interior with an inner surface **12** and an open terminal end **14**. The handlebar **10** can be, for example, for a bicycle or other vehicle that utilizes such a hydraulic brake control apparatus. The tubular member can have a circular cross-sectional shape, or other non-circular (e.g., oval, square, etc.) cross-sectional shape if desired. The control lever **100** of the hydraulic brake control apparatus is configured to be mounted to the end **14** of the handlebar **10**, with at least a portion of the components of the hydraulic brake apparatus received within the hollow interior of the handlebar **10**.

The hydraulic brake control apparatus includes a hydraulic brake control mechanism including a hydraulic brake pressure cylinder or master cylinder **131**, the operation of which is discussed in greater detail below with respect to FIGS. **3** and **5**. The hydraulic brake pressure cylinder **131** and various components thereof are housed within a section **130** of a body portion **110** of the control lever **100**, and are actuated by a lever portion **160** of the control lever **100**.

Referring to FIGS. **1-5**, the control lever **100** includes a body portion **110** having an exterior section **112** that is configured to be outside of the tubular member or bar opening when mounted to the handlebar **10**, and the interior section **130** that is configured to fit within the interior of a tubular member or bar opening.

The exterior section **112** of the body portion **110** includes a lip portion **114** that abuts against the end **14** of the handlebar **10** when the control lever **100** is mounted to the handlebar **10**. The exterior section **112** includes a hole **116** that extends therethrough that receives an axle **170** that is used to pivotally mount the lever portion **160** to the body portion **110**. The exterior section **112** includes openings or ports **118** and **119** that each house a valve that can be used to inject hydraulic fluid into the hydraulic pressure cylinder **131** and/or bleed air out of the hydraulic pressure cylinder **131**. The exterior section **112** also includes a recessed portion **120** that receives an upper end **162** of the lever portion **160** for pivotal actuation thereof about the axle **170**.

The interior section **130** of the body portion **110** houses the hydraulic brake pressure cylinder **131**. The interior section **130** includes a mounting surface **132** on a lower side thereof, and an inclined surface **134** on an outer upper surface thereof. The mounting surface **132** is configured to press against the

inner surface **12** of the handlebar **10** when the control lever **100** is mounted on the end **14** of the handlebar **10**. The inclined surface **134** is inclined to slant upwards and away from the mounting surface **132** as the inclined surface **134** approaches the exterior section **112**.

The control lever **110** includes a mounting portion or mounting block **140** that is connected to the body portion **110** by mounting screws or bolts **150** and **152**. The mounting portion **140** has threaded holes **142** and **144** that are threadably engaged to the threaded mounting screws **150** and **152**, respectively. The mounting portion **140** has a lower curved surface **146** that is configured to slidably receive or abut the inclined surface **134**. The mounting portion **140** has an upper surface **148** that is configured to press against the inner surface **12** of the handlebar **10** when the control lever **100** is mounted on the end **14** of the handlebar **10** and the mounting screws are rotated to draw the mounting portion **140** towards the exterior section **112**. The mounting portion has a generally U-shaped configuration; however, is mounted in an inverted manner.

The mounting screws **150** and **152** are inserted through apertures **122** and **124**, respectively, in the exterior section **112** of the body portion **110**. The mounting screws can be inserted via the recessed portion **120**, as can be seen in FIG. **2**. The apertures **122** and **124** are configured to receive the mounting screws **150** and **152** such that the mounting screws can move in a direction perpendicular to a longitudinal axis of the mounting screws when the mounting portion **140** slides along the inclined surface **134**. For example, the mounting screws **150** and **152** can be mounted such that they pivot about the head thereof, and/or slide upward or downward. The pivoting/sliding of the mounting screws allows the elevation of the screws or the terminal ends of the screws to change upward or downward as the mounting portion **140** slides to the right or the left, respectively, as shown by the arrows in FIG. **3**. The mounting screws **150** and **152** are generally provided at a different angle from the hydraulic pressure cylinder **131** and the inclined surface **134** when connected to the mounting portion **140**.

The apertures **122** and **124** can provide for such pivoting of the mounting screws **150** and **152**, for example, by providing the apertures with a generally truncated cone-shaped cross-section (not shown) when taken along a plane parallel to the cross-sectional plane of FIG. **3**, where a narrower end of the truncated cone is on a right side as viewed in the same orientation of FIG. **3** and a wider end of the truncated cone is on a left side. Thus, the heads of the mounting screws **150** and **152** will retain the screws **150** and **152** in connection with the exterior section **112** of the body portion **110** by the narrower end of the truncated cone, and the wider end will allow the terminal ends of the mounting screws to move upward or downward as the mounting portion **140** slides along the inclined surface **134**. Alternatively, or in addition to the embodiment described above, the apertures **122** and **124** can provide for movement/pivoting of the mounting screws **150** and **152** by providing the apertures **122** and **124** with a slot shape, for example, a shape having two semi-circular ends connected by two straight sides.

Accordingly, as the mounting screws **150** and **152** are rotated within the apertures **122** and **124**, the threads on the mounting screws **150** and **152**, which are threadably engaged to the threaded holes **142** and **144** on the mounting portion **140**, will act to slide the mounting portion **145** along inclined surface **134**. Therefore, in order to tightly mount the control lever **100** to the handlebar **10**, the control lever **100** is positioned as shown, for example, in FIG. **3**, and then the mounting screws **150** and **152** are rotated in a direction that pulls the mounting portion **140** in a rightward direction towards the exterior section **112** until the upper surface **148** of the mounting portion **140** contacts the inner surface **12** of the handlebar **10**. Then, as the mounting screws **150** and **152** are further rotated/tightened, the upper surface **148** of the mounting portion **140**, due to interaction between the mounting portion **140** and the inclined surface **134**, will push/press against the inner surface **12** of the handlebar and the lower mounting surface **132** will push/press against an opposite side of the inner surface **12** of the handlebar **10** in order to firmly mount the control lever **10** to the handlebar **10**.

It is preferable to provide a feature, for example, an expanded portion or pin or other feature at the terminal end of the mounting screws, that prevents the mounting portion from becoming disengaged from the mounting screws.

Alternative embodiments of the control lever can include a configuration in which one mounting screw is utilized. In such a configuration, the mounting portion and/or the inclined surface is/are preferably configured to prevent the ability of the mounting portion to rotate within the interior of the handlebar as the mounting screw is rotated. Further alternative embodiments can be provided in which a channel or groove extends along the upper surface of the inclined surface, and the mounting portion is received within the groove or has a projection that extends within the groove in order to guide the mounting portion along the inclined surface.

As can be seen in FIGS. **1-3**, the control lever **100** further includes the lever portion **160**. The lever portion **160** has an upper end **162** and a lower end **164**. The upper end **162** of the lever portion **160** is pivotally mounted to the exterior section **112** by the axle **170** mounted within hole **116** that extends through the exterior section **112** on both sides of the recessed portion **120**. The lower end **164** of the lever portion **160** can be used as a handle by the user to actuate the control mechanism of the hydraulic brake control apparatus by pulling the lower end **164** towards the handlebar **10**.

With reference to FIGS. **3** and **5**, the hydraulic brake control apparatus includes a hydraulic brake control mechanism including the hydraulic brake pressure cylinder **131**. The hydraulic brake pressure cylinder **131** and various components thereof are housed within a section **130** of a body portion **110** of the control lever **100**, and are actuated by a lever portion **160** of the control lever **100**. At a distance spaced apart from the axle **170**, the lever portion **160** is pivotally attached to a push-rod **190** by a pin **180**. The pin **180** is fixed to a first end **192** of the push-rod **190**, and the pin **180** is configured to pivot with respect to the lever portion **160**. A second end **194** of the push-rod **190** is pivotally fixed to a piston **196**. The piston **196** has a seal **197** (e.g., an O-ring, etc.) and is slidably provided within a piston chamber **200** of the hydraulic brake pressure cylinder **131**. Hydraulic fluid is provided within the chamber **200**. A cap **201** is provided on the end of the chamber **200**, which allows the push-rod **190** to extend therethrough, but generally seals the components of the hydraulic brake pressure cylinder **131** to surrounding environment conditions.

Therefore, when the lever portion **160** is rotated in a clockwise direction in FIG. **3** about axle **170**, the pin **180** will push the push-rod **190** and the piston **196** in a leftward direction within the chamber **200**, thereby forcing hydraulic fluid out of port **202**. Although not shown in the drawings, port **202** will be connected to a hydraulic tube that will carry the hydraulic fluid to a disc brake mounted beside a wheel of the bicycle in order to actuate the hydraulic brake and apply a braking force to the wheel of the bicycle. Once the user releases the lever portion **160**, then the lever portion **160** will rotated in a counterclockwise direction in FIG. **3** about axle **170**, and the

push-rod **190** and the piston **196** will move in a rightward direction within the chamber **200**, thereby releasing the braking force.

The chamber **200** of the hydraulic pressure cylinder **131** has a pipe or conduit **204** that is fluidly connected to the chamber **200** and extends in an inclined direction from the chamber to the openings **118** and **119**, which can each house a valve and can be used to inject hydraulic fluid into the hydraulic pressure cylinder **131** and/or bleed air out of the hydraulic pressure cylinder **131**. The pipe **204** is connected to an upper or elevated area **206** of the chamber **200**.

Embodiments of the present invention advantageously provide a control lever **100** that has a hydraulic pressure cylinder **131** with a chamber **200** therein that is provided at an inclined angle with respect to horizontal when a bicycle to which it is attached is provided in a generally vertical orientation. In other words, the chamber **200** is provided in an inclined manner such that any air or air bubbles within the chamber **200** will collect at the elevated area **206** at the uppermost corner of the chamber **200**. The chamber **200** is configured to have an axis along which the piston **196** travels that is at an inclined angle as compared to an axis of the handlebar **10** when the control lever **100** is mounted on the handlebar **10**. Additionally, the pipe **204** is connected to the elevated area **206** of the chamber **200** in order to allow air within the chamber to be bled out of the chamber **200**, for example, via either opening **118** or opening **119**. The pipe **204** is also provided at an inclined angle in order to aid in the bleeding out of air from within the chamber **200**.

Embodiments of the present invention advantageously provide a control lever in which such openings **118** and **119** are both provided at locations on the exterior section **112** of the body portion **110**, and therefore are accessible when the control lever **100** is mounted to the handlebar **10**. Thus, it is possible to perform a bleeding operation when the control lever **100** is attached to the handlebar **10**. Notably, the opening **118** provides a further advantageous orientation in that it is also not blocked in any manner by the presence of the lever portion **160** or any other feature of the control lever **100**.

As can be seen in FIG. **5**, for example, a funnel **210** can be used to perform the bleeding operation via opening **118**. The funnel **210** includes a port **212** that is connected to an inner chamber **214** of the funnel. Accordingly, the port **210** can be inserted within the opening **118** in order to perform the bleeding operation. Alternatively, an air bleed nipple can be provided on the opening **118** in order to allow air to be released from the chamber **200**.

It should be noted that the exemplary embodiments depicted and described herein set forth the preferred embodiments of the present invention, and are not meant to limit the scope of the claims hereto in any way. Numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed is:

1. A hydraulic brake control apparatus comprising:

a body portion having a first section configured to fit within an interior of a bar opening of a handlebar and a second section configured to be mounted outside of the interior of the bar opening;

a hydraulic brake control mechanism including a hydraulic brake pressure cylinder having a piston chamber therein, at least a portion of said hydraulic brake control mechanism being housed within said first section of said body portion; and

a lever portion connected to said body portion and configured to actuate said hydraulic brake control mechanism,

wherein said body portion includes a port fluidly connected to said piston chamber by a conduit, said port being provided on said second section of said body portion and said conduit extending into the first section of the body portion within the interior of the bar opening in order to allow bleeding of air from within said piston chamber when said body portion is mounted to the bar opening, said port having an end opening arranged radially and axially outside of the handlebar having the bar opening.

2. The hydraulic brake control apparatus according to claim **1**, wherein said piston chamber is provided within said first section.

3. The hydraulic brake control apparatus according to claim **1**, wherein said conduit is provided at an inclined angle such that said conduit is inclined as compared to an axis of the bar opening when the body portion is mounted to the bar opening.

4. The hydraulic brake control apparatus according to claim **1**, wherein said port is provided on an outer surface of said second section.

5. The hydraulic brake control apparatus according to claim **1**, wherein said hydraulic brake control mechanism further includes a piston slidably provided within said piston chamber along an axis thereof.

6. The hydraulic brake control apparatus according to claim **5**, wherein said axis of said piston chamber is provided at an inclined angle such that said axis is inclined as compared to an axis of the bar opening when the body portion is mounted to the bar opening.

7. The hydraulic brake control apparatus according to claim **6**, wherein said piston chamber has an elevated area at one end thereof, and wherein said conduit is fluidly connected to said piston chamber at said elevated area.

8. The hydraulic brake control apparatus according to claim **1**, wherein the body includes an additional port fluidly connected to said piston chamber by the conduit.

9. The hydraulic brake control apparatus according to claim **8**, wherein said additional port is provided on said second section of said body portion, said additional port having an end opening arranged axially outside of the handlebar having the bar opening.

10. The hydraulic brake control apparatus according to claim **9**, wherein said end opening of said additional port not being arranged radially outside of the handlebar having the bar opening.

11. The hydraulic brake control apparatus according to claim **10**, wherein said end opening of said additional port facing said lever portion.

12. A hydraulic brake control apparatus comprising:

a body portion having a first section configured to fit within an interior of a bar opening and a second section configured to be mounted outside of the interior of the bar opening;

a hydraulic brake control mechanism including a hydraulic brake pressure cylinder having a piston chamber therein, at least a portion of said hydraulic brake control mechanism being housed within said first section of said body portion;

a lever portion connected to said body portion and configured to actuate said hydraulic brake control mechanism;

a mounting portion configured to slide on an inclined surface on an outer circumferential surface of said first section; and

at least one mounting screw configured to connect said mounting portion to said body portion,

wherein said at least one mounting screw is configured to slide said mounting portion along said inclined surface so as to push said mounting portion and a side of said first section against an inner surface of the bar opening in order to mount said body portion to the bar opening,

wherein said at least one mounting screw extends through an aperture in said second section, wherein said at least one mounting screw is threadably engaged to a threaded hole on said mounting portion, and

wherein said aperture in said second section is configured to receive said at least one mounting screw such that said at least one mounting screw moves in a direction perpendicular to a longitudinal axis of said at least one mounting screw when said mounting portion slides along said inclined surface.

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